REMARKS

Claims 7-11 and 21-47 are pending in the present application and claims 21-47 have been allowed. Reconsideration and allowance of outstanding claims 7-11 in view of the following remarks are requested.

In the Office Action dated March 26, 2004, the Examiner has ***finally rejected*** claims 7-11 pending in the application on the basis of new ground(s) of rejection and newly cited art. Applicant respectfully requests reconsideration and withdrawal of the finality of the rejection of the Office Action dated March 26, 2004.

A good and sufficient reason why the present response is necessary and was not earlier presented is that an entirely new reference has been cited in the present final rejection dated March 26, 2004 (37 CFR §1.116(c)). The new reference is Chiang et al. (USPN 6,488,823) (hereinafter "Chiang"), which is for the first time brought to Applicant's attention by means of the present ***final rejection*** dated March 26, 2004. The new reference, i.e. Chiang, was not cited in the present application prior to the instant final rejection. Since Chiang is a reference upon which the Examiner has now relied, Applicant believes that it would be manifestly unfair for the Patent Office not to consider Applicant's arguments, which are necessitated due to the newly cited reference, Chiang.

The Examiner has rejected claims 7 and 10-11 under 35 USC §103(a) as being unpatentable over U.S. patent number 6,146,959 to DeBoer et al ("DeBoer") in view of Chiang. For the reasons discussed below, Applicant respectfully submits that the present

invention, as defined by independent claim 7, is patentably distinguishable over DeBoer and Chiang, singly or in combination.

The present invention, as defined by independent claim 7, teaches a capacitor comprising a dielectric comprising ceramic tantalum nitride situated between first and second capacitor electrodes, where the dielectric comprises ceramic tantalum nitride having a nitrogen content of at least 30%. As disclosed in the present application, the present invention can achieve ceramic tantalum nitride by fabricating tantalum nitride with a nitrogen content of at least 30%. In the ceramic mode, tantalum nitride exhibits a high dielectric constant, which allows the present invention to utilize ceramic tantalum nitride as a dielectric to advantageously achieve a capacitor having a relatively high capacitance density. As further disclosed in the present application, the fabrication of ceramic tantalum nitride can be easily integrated in copper processes. For example, the entire process of fabricating ceramic tantalum nitride can be done in the same tool where copper interconnect is fabricated without a need to "break vacuum."

In other words, a layer of ceramic tantalum nitride could be fabricated as a dielectric above a copper interconnect segment without having to take the semiconductor wafer out of the vacuum chamber for a separate fabrication of the dielectric. Thus, by utilizing ceramic tantalum nitride as a dielectric in a capacitor having copper plates, the present invention advantageously achieves a capacitor having a relatively high capacitance density that can advantageously be built with higher throughput while advantageously reducing the risk of wafer contamination.

In contrast to the present invention as defined by independent claim 7, DeBoer does not teach, disclose, or suggest a capacitor comprising a ceramic tantalum nitride dielectric, where the dielectric comprising ceramic tantalum nitride has a nitrogen content of at least 30%. DeBoer specifically discloses capacitor 10, which comprises Ta_2O_5, i.e. tantalum pentoxide, layer 18 situated between silicon nitride layer 16 and second nitride layer 20. See, for example, column 1, lines 56-67, column 2, lines 16-17 and Figure 1 of DeBoer. DeBoer further discloses that tantalum pentoxide is generally amorphous if formed below 600° C and will be crystalline if formed, or later processed. at or above 600° C. See, for example, column 2, lines 9-11. However, DeBoer discloses fabricating tantalum pentoxide at a temperature below 600° C to form amorphous tantalum pentoxide, which is different than ceramic tantalum nitride. Thus, DeBoer fails to teach, disclose, or suggest forming ceramic tantalum nitride.

Furthermore, DeBoer is concerned with developing alternative methods of utilizing tantalum pentoxide in integrated circuit construction as a result of the high dielectric constant of tantalum pentoxide, i.e. approximately 25. See, for example, DeBoer, column 1, lines 16-17, and column 2, lines 47-48. In contrast, as disclosed in the present application, the dielectric constant of ceramic tantalum nitride is approximately 10. Thus, since tantalum pentoxide has a higher dielectric constant than ceramic tantalum nitride, DeBoer would not be motivated to replace a dielectric having a higher dielectric constant, i.e. tantalum pentoxide, with a dielectric having a lower dielectric constant, i.e. ceramic tantalum nitride.

Moreover, DeBoer fails to teach, disclose, or suggest fabricating a capacitor having copper plates. As discussed above, the present invention advantageously utilizes ceramic tantalum nitride as a dielectric in a capacitor having copper plates to achieve a capacitor with relatively high capacitance that can advantageously be built with higher throughput while advantageously reducing the risk of wafer contamination. However, DeBoer fails to teach, disclose, or even remotely suggest a similar motivation or other motivation for combining ceramic tantalum nitride and copper to fabricate a capacitor.

In contrast to the present invention as defined by independent claim 7, Chiang does not teach, disclose, or suggest a capacitor comprising a ceramic tantalum nitride dielectric, where the dielectric comprising ceramic tantalum nitride has a nitrogen content of at least 30%. Chiang is directed to controlling residual stress in a tantalum or tantalum nitride film during deposition by adjusting process variables which have counteracting effects on the residual film stress. The Examiner has cited Chiang to disclose that when the atomic nitrogen content of a tantalum nitride film exceeds about 45% to about 50%, the resistivity of the tantalum nitride film increases drastically. See, for example, Chiang, column 9, lines 27-36. However, Chiang does not teach or disclose a dielectric comprising ceramic tantalum nitride having a nitrogen content of at least 30%. In fact, Chiang does not even mention ceramic tantalum nitride. Furthermore, Chiang provides no motivation for combining the tantalum nitride film having a nitrogen content that exceeds about 45% to about 50% with copper to form a capacitor.

Furthermore, DeBoer provides no motivation for combining the tantalum nitride film with copper to form a capacitor having copper plates, or even for utilizing the tantalum nitride film as a dielectric in a capacitor that does not have copper plates. As discussed above, DeBoer discloses using tantalum pentoxide, which has a high dielectric constant of approximately 25, as a capacitor dielectric. In contrast, as discussed above, ceramic tantalum nitride has a much lower dielectric constant of approximately 10. Thus, DeBoer would not be motivated to replace a dielectric with a high dielectric constant, i.e. tantalum pentoxide, with a dielectric with a lower dielectric constant, i.e. a tantalum nitride film. Thus, neither DeBoer nor Chiang provide a motivation for forming a capacitor, such as a capacitor with copper plates, utilizing ceramic tantalum nitride. Thus, the teachings suggested by the Examiner, i.e. the combination of DeBoer and Chiang, are based on a classic hindsight reconstruction given the benefit of Applicant's disclosure, which is impermissible.

For the foregoing reasons, Applicant respectfully submits that the present invention, as defined by independent claim 7, is not suggested, disclosed, or taught by DeBoer and Chiang. Thus, independent claim 7 is patentably distinguishable over DeBoer and Chiang and, as such, claims 10 and 11 depending from independent claim 7 are, *a fortiori*, also patentably distinguishable over DeBoer and Chiang for at least the reasons presented above and also for additional limitations contained in each dependent claim.

The Examiner has further rejected claims 8 and 9 under 35 USC §103(a) as being unpatentable over DeBoer in view of Chiang and further in view of U.S. patent number 5,170,318 to Catala et al ("Catala"). As discussed above, independent claim 7 is patentably distinguishable over DeBoer and Chiang and, as such, claims 8 and 9 depending from independent claim 7 are, *a fortiori*, also patentably distinguishable over DeBoer and Chiang for at least the reasons presented above and also for additional limitations contained in each dependent claim. Moveover, the features of independent claim 7, for example a dielectric comprising ceramic tantalum nitride situated between a first and second capacitor electrode, are not suggested, disclosed, or taught anywhere in Catala. As such, independent claim 7 as well as claims 8 and 9 depending therefrom are also patentably distinguishable over DeBoer and Chiang in combination with Catala.

Based on the foregoing reasons, the present invention, as defined by independent claim 7, and claims depending therefrom, is patentably distinguishable over the art cited by the Examiner. Thus, claims 7-11 are patentably distinguishable over the art cited by the Examiner. For all the foregoing reasons, an early allowance of outstanding claims 7-11, and an early Notice of Allowance for all pending claims 7-11 and 21-47 is respectfully requested.

Attorney Docket No.: 99CON103P-DIV1

Respectfully Submitted,
FARJAMI & FARJAMI LLP

Date: 6/21/04

Michael Farjami, Esq.
Reg. No. 38, 135

Michael Farjami, Esq.
FARJAMI & FARJAMI LLP
26522 La Alameda Ave., Suite 360
Mission Viejo, California 92691
Telephone: (949) 282-1000
Facsimile: (949) 282-1002

CERTIFICATE OF FACSIMILE TRANSMISSION
I hereby certify that this correspondence is being filed by facsimile transmission to United States Patent and Trademark Office at facsimile number **703-872-9306** on the date stated below. The facsimile transmission report indicated that the facsimile transmission was successful.

Date of Facsimile: 6/21/2004

LESLEY L. LAM
Name of Person Performing Facsimile Transmission

Signature 6/21/04
Date

CERTIFICATE OF MAILING
I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

Date of Deposit:_____

_____
Name of Person Mailing Paper and/or Fee

_____
Signature Date

[redacted]